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(51) INT CL⁶

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G4A AAP

(56) Documents Cited

WO 92/21082 A1 WO 91/07826 A1 US 5111004 A

(58) Field of Search

UK CL (Edition O) F2Y YSP YSX YTA , G4A AAP

INT CL⁶ A61B 5/117 , G06F 1/00 , G06K 9/00 11/18
11/20

Online:WPI

(54) A computer mouse

(57) A mouse 10 for operating a computer 25 includes operating keys 12, and means 11 for verifying or recognising biometric features, such as fingerprints, palm prints, other characteristics of the hands or fingers, or voice, of one or more users to permit or deny access to the computer. The mouse may be linked to the computer by a cable 13 or by infrared transmission means. All the fingerprint verification or recognition circuitry is contained in the mouse, and initially a fingerprint is sensed by a sensor 24 and stored in memory 21 to identify, on future occasions, an authorised user.

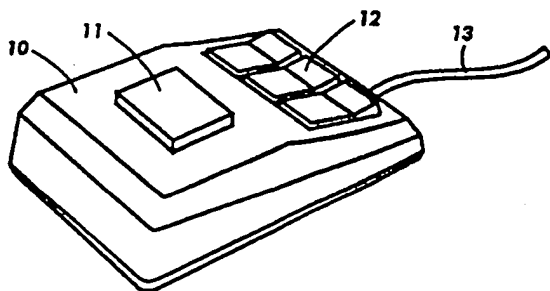


FIG. 1

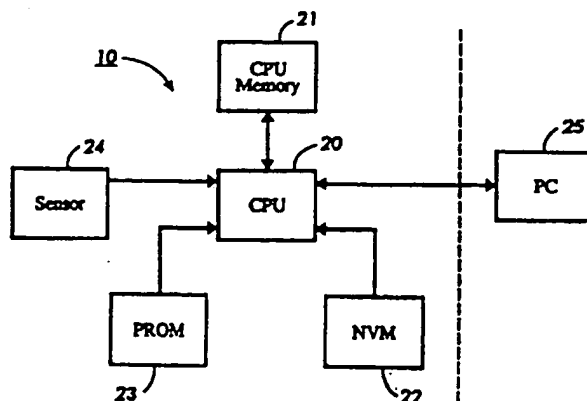


FIG. 2

MOUSE FOR A COMPUTER

This invention relates to a mouse for operating a computer.

The use of a mouse, in addition to a keyboard, has become well established for personal computers. By moving a mouse over a surface, such as the surface of a table or desktop, or of a special pad, the user is able to move a representation of a pointer over a computer screen, and can select an operation (described or represented by an icon on the screen) by using one or more buttons carried by the mouse.

One of the main problems with computers, whether stand-alone or connected to a network, is that of security. To prevent unwanted users from gaining access to a given computer or network, a system of passwords is usually employed. With such a system, each time a user starts up his computer, or logs onto a network, he enters a password. Even this system has disadvantages. The user must remember his password, and then enter it each time he logs on. Also, users are often required to change their passwords at regular intervals. Additional security may be provided by making it necessary to re-enter the password every time the computer has been left unused for a predetermined period of time, so that if an authorised user is called away from his computer he does not have to log out or switch it off. This approach, however, makes it inconvenient for the authorised user. Furthermore, passwords are not always completely secure; they can be discovered by chance, or as a result of negligence by the authorised user, or by trial and error.

It is an object of the present invention to provide a mouse for a computer which overcomes these disadvantages.

According to the present invention, there is provided a mouse for operating a computer, the mouse including means for verifying or recognising biometric features of one or more users to permit or deny access to the computer.

The means for verifying or recognising biometric features may include a sensor, recognition circuitry responsive to the sensor for providing electrical codes representing one or more biometric features of a user, a memory for storing codes representing said biometric features of one or more authorised users, and verification or recognition circuitry for comparing said electrical codes with said codes stored in memory.

The means for verifying or recognising biometric features preferably comprises fingerprint recognition means.

The mouse of the invention has the advantage that it makes the computer, or the computer network, much more secure than using a password, while at the same time completely removing one level of interface between the user and the computer. In other words, when an authorised user wants to log on to his computer, it is only necessary to touch the mouse (in the recognition mode) or enter his user name and touch the mouse (in the verification mode) and the computer is ready for use. This is also a valuable time saver if the computer uses the 'time-out' feature, whereby, rather than re-entering his password after a time-out, he only needs to touch the mouse. The use of

fingerprints for verification of an authorised user has, of course, the added advantage that fingerprints, so far as is known, are unique to a given person, do not need to be remembered, and cannot be discovered like a password can.

A mouse for a computer in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view of the mouse; and

Fig. 2 is a schematic of the circuits used in the mouse.

Referring to Fig. 1, the mouse 10 of the invention is of the same general configuration and size as any standard mouse, but is modified by the inclusion of a fingerprint verification or recognition device, which may have a sensor comprising a small platen 11. In standard fashion, the mouse has function keys 12, and a cable 13 to connect it to a computer. Alternatively, the mouse may be linked to the computer by infra-red transmission means. The mouse may operate by any of the known systems, such as a rolling ball as a movement sensor, or a light and photosensor system using a dedicated mat or pad having a regular pattern of markings.

Although the use of a fingerprint verification or recognition device is described herein, any suitable biometric verification or recognition system may be used, i.e. systems which measure characteristics of the user such as palm prints; sizes, shapes, temperatures, pressures, colours or smells of hands or fingers; or voice.

Examples of fingerprint recognition systems are described in EP-A-0,640,933, EP-A-0,459,712, EP-A-0,348,182, EP-A-0,071,269 and US-A-5,373,181. Various sensing arrangements are described in these patents, including optical, electrical and pressure sensing devices. They all have in common the fact that they produce a set of electrical signals, or code, representing selected characteristics of the fingerprint. In some of these systems, the amount of information required to characterise a fingerprint can be very large. One way of reducing the amount of information needed to characterise a complete fingerprint is described in the article "Little Waves, Big Squeeze", published in the New Scientist, 2 March, 1996. For verification purposes, however, it may not be necessary to characterise the complete fingerprint, but to use only selected features. In order to 'read' the fingerprint consistently, it may be desirable to locate the platen or other sensing area within a cavity of appropriate shape to take the end of a finger, to allow a more accurate placement of the finger.

Referring now to Fig. 2, the mouse contains the necessary circuits to enable it to function as an accessory to a wide range of computers. To this end, it contains all the fingerprint verification or recognition circuitry (rather than relying on the computer for this function). A typical arrangement includes a CPU 20, with its own working memory 21, a programmable read only memory (PROM) 23 such as an EEPROM, for storing the fingerprint recognition software, and a non-volatile memory (NVM) 22, for storing the electrical codes representing the fingerprints of authorised users. Input is provided by an appropriate sensor 24, which may be, for example, an optical, electrical or pressure

sensitive sensor. The mouse is connected by cable 13 to a computer 25 such as a personal computer.

In operation, the mouse has two modes; a learn mode, in which a fingerprint is initially recognised and stored to identify, on future occasions, an authorised user, and a normal mode, either for verification or for recognition of the user, in which the mouse will only give computer access to an authorised user.

In an example of the learn mode, the process is as follows:

- 1) The learn mode is established, for example by inserting a disc containing the initialisation routine software, to enable the mouse to communicate with the computer. In a network system, it might also be made necessary to open up the process by means of a systems administrator.
- 2) The computer prompts the user for a user name.
- 3) The user enters the user name into the computer.
- 4) The computer prompts the user to place the selected finger onto the fingerprint sensor on the mouse.
- 5) The sensor scans the fingerprint and generates the fingerprint code.
- 6) The fingerprint code is stored in the NVM against the user name.
- 7) A unique 'go-code' is generated for each fingerprint (or for the individual mouse).
- 8) The go-code is stored in both NVM and the computer.

In an example of the normal mode, for verification of the user, the process is as follows:

- 1) The computer prompts the user for a user name.
- 2) The user enters the user name into the computer.
- 3) The computer prompts the user to place the selected finger onto the fingerprint sensor on the mouse.
- 4) The sensor scans the fingerprint and generates the fingerprint code.
- 5) The fingerprint code is stored temporarily in CPU memory.
- 6) The CPU compares this fingerprint code with the fingerprint of the authorised user stored in the NVM.
- 7) If there is a match, the mouse transmits the go-code to the computer, and the computer allows the user access to the system.
- 8) If there is no match, the mouse transmits a stop-code to the computer, which denies the user access to the system.

In an example of the normal mode, for recognition of the user, the process is as follows:

- 1) The computer prompts the user to place the selected finger onto the fingerprint sensor on the mouse.
- 2) The sensor scans the fingerprint and generates the fingerprint code.
- 3) The fingerprint code is stored temporarily in CPU memory.
- 4) The CPU compares this fingerprint code with the fingerprints of the authorised users stored in the NVM.

- 5) If there is a match, the mouse transmits the go-code to the computer, and the computer allows the user access to the system.
- 6) If there is no match, the mouse transmits a stop-code to the computer, which denies the user access to the system.

The mouse can be supplied substantially ready for use, along with the relevant initialisation software, which might conveniently be supplied on a floppy disc. Once an authorised user has set up the mouse as described above, no-one else can use the computer unless authorised in the same way as the first authorised user, the authorisation of second and subsequent users being controlled such that for example, only the first authorised user can admit subsequent authorised users, or substitute alternative users.

It is known to use fingerprint recognition to allow access to a computer, as described for example in EP-A-0,348,182, column 7, lines 49 - 59, where a fingerprint recognition system is built in to a keyboard. The mouse of the present invention offers considerable benefits, however, in that it can be used with existing computers or systems without modification, and without the need to add any other components other than replacing the mouse, which is the least expensive part of a computer set-up.

Claims:

1. Mouse for operating a computer, the mouse including means for verifying or recognising biometric features of one or more users to permit or deny access to the computer.
2. The mouse of claim 1 wherein said means for verifying or recognising biometric features comprises fingerprint recognition means.
3. The mouse of claim 1 or claim 2 wherein said means for verifying or recognising biometric features includes a sensor; recognition circuitry responsive to the sensor for providing electrical codes representing one or more biometric features of a user, a memory for storing codes representing said biometric features of one or more authorised users, and verification or recognition circuitry for comparing said electrical codes with said codes stored in memory.
4. The mouse of claim 3 including means for entering into the memory, during an initialisation operation, said codes of authorised users, and means for preventing changes to said stored codes other than by authorised users.
5. The mouse of claim 4 wherein, during the initialisation operation, the mouse generates a mouse recognition code, and instructs the computer to operate only in response to that mouse code, the mouse code being generated either randomly during initialisation, or being a unique code pre-programmed into the mouse, or being generated from predetermined parameters of the electrical codes representing the biometric feature.
6. The mouse of any one of claims 1 to 5 wherein said memory is a non-volatile memory, and wherein the code of an authorised user can be changed only in response to successful verification or recognition of the biometric feature, or in response to the entry of a password.

bereits erkannte Person oder den betreffenden Personenkreis vorgesehen ist. Dementsprechend erfolgt dann erneut eine Gewichtung der in den verschiedenen Verfahren ermittelten Daten. Das Ergebnis dieser erneuten Auswertung der Daten ermöglicht dann die Entscheidung, ob eine Erkennung in einer vorgesehenen Sicherheitsstufe als erfolgt oder als nicht erfolgt anzunehmen ist.

Für die Kombination der Biometrien bzw. Erkennungsverfahren werden vorzugsweise verschiedene Sicherheitsmodi eingeführt. Die Auswahl dieser Sicherheitsmodi ist dabei sowohl in der elektronischen Schaltung programmiert als auch benutzerdefiniert (Eingabe einer PIN oder eines Paßwortes) möglich. Das hängt von den jeweiligen Sicherheitsanforderungen der Anwendung ab. Vorzugsweise wird bei der elektronischen Auswertung in Abhängigkeit von den vorhandenen Sicherheitsanforderungen automatisch entschieden, welche der verwendeten Verfahren zur Erkennung zu welchem Grade bei der Ermittlung des Erkennungsergebnisses angewendet werden sollen. Ist beispielsweise bei der Unterschriftenanalyse das Ergebnis der Erkennung negativ, aber nur mit geringer Wahrscheinlichkeit, hat sich der Fingerabdruck hingegen mit hoher Wahrscheinlichkeit als der zu erkennende Fingerabdruck erwiesen, so kann die elektronische Auswertung zu einer positiven Erkennung und damit der Berechtigung eines Zugangs führen. Die Ablehnung der Unterschrift wird dann darauf zurückgeführt, daß die Unterschrift in Hektik oder Unruhe zu schnell und zu undeutlich geleistet wurde.

Hat der Benutzer selbst die Möglichkeit, auszuwählen, welches Verfahren der Erkennung mit dem höchsten Gewichtungsfaktor versehen werden soll oder ausschließlich zur Erkennung herangezogen werden soll, kann insbesondere bei Anwendungen mit geringem Sicherheitsbedarf sichergestellt werden, daß der Benutzer in jedem Fall seine Erkennung herbeiführen kann. Er ist dann unabhängig von dem momentanen Zustand seines Fingerabdrucks, seiner Stimme oder seiner für die Qualität der Unterschrift maßgeblichen Motorik. Die Möglichkeit, seitens des

- Benutzers ein Erkennungsverfahren, das bei dem erfindungsge-
mäßen Verfahren in Kombination mit anderen eingesetzt wird,
abzuschalten, kann z. B. zeitlich begrenzt werden, um eine
Verringerung der erzielbaren Sicherheit nur zeitlich befristet
5 zu gewähren und dadurch zu verhindern, daß das System
dauerhaft mit dem Einsatz nur eines biometrischen Erkennungs-
verfahrens benutzt wird, was die Fälschungssicherheit redu-
zieren würde.

Patentansprüche

1. Verfahren zur biometrischen Erkennung,
bei dem eine Beurteilung einer Erkennung anhand technisch er-
5 mittelster personenbezogener Daten durchgeführt wird, indem
in einem ersten Schritt ein Verfahren zur biometrischen Er-
kennung und mindestens ein davon verschiedenes weiteres tech-
nisches Verfahren zur Erkennung durchgeführt werden,
in einem zweiten Schritt aus diesem Verfahren resultierende
10 Daten mittels einer elektronischen Schaltung gewichtet werden
und
in einem dritten Schritt aus den gewichteten Daten ein Maß
für ein Zutreffen einer Erkennung ermittelt wird.
- 15 2. Verfahren nach Anspruch 1, bei dem
in dem zweiten Schritt die Daten in Abhängigkeit von vorher-
gehenden Anwendungen des Verfahrens gemäß einer in der elek-
tronischen Schaltung implementierten Rechenvorschrift gewich-
tet werden.
- 20 3. Verfahren nach Anspruch 1, bei dem
in dem zweiten Schritt die Daten entsprechend einer jeweili-
gen Eingabe in die elektronische Schaltung gewichtet werden.
- 25 4. Verfahren nach Anspruch 1, bei dem
zwischen dem ersten Schritt und dem zweiten Schritt aus den
Daten bestimmt wird, wie die Daten in dem zweiten Schritt ge-
wichtet werden.

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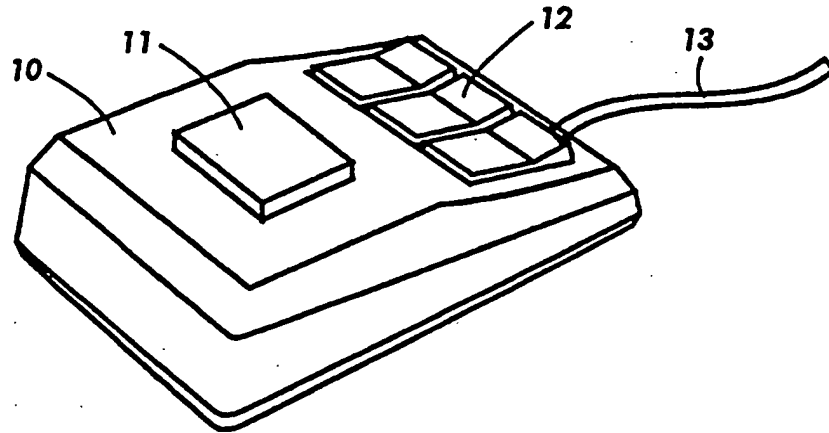


FIG. 1

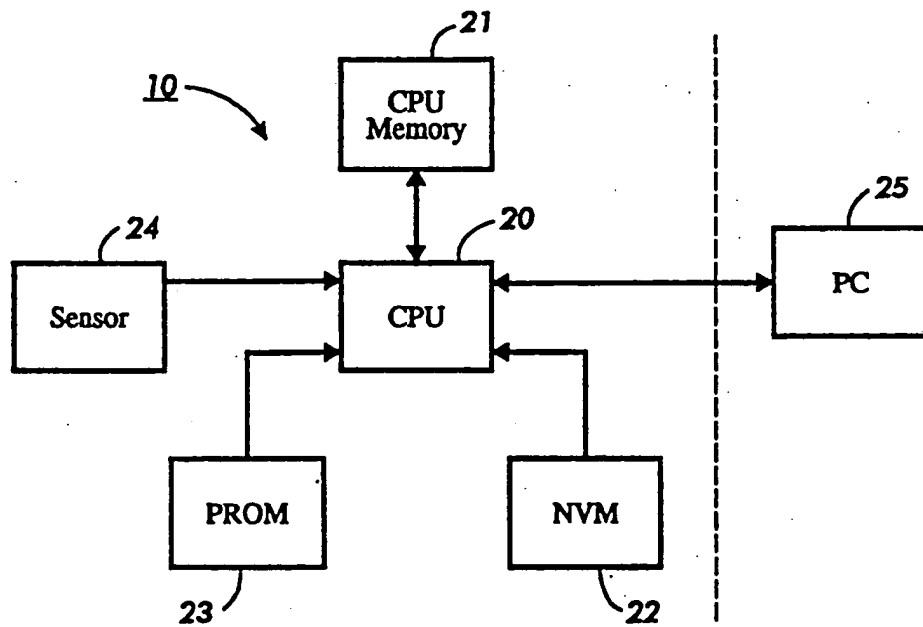


FIG. 2



The
Patent
Office

6

Application No: GB 9607701.1
Claims searched: 1-6

Examiner: Peter Squire
Date of search: 12 June 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F2Y YSP YSX YTA G4A AAP

Int Cl (Ed.6): A61B 5/117 G06F 1/00 G06K 9/00 11/18 11/20

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	WO 92/21082 A1 (Eden Group Limited) see e.g. page 4 lines 7-18 and page 6 line 14	1, 2
Y	WO 91/07826 A1 (Russell) see page 16 line 20 - page 18 line 28	1, 2, 3
Y	US 5111004 (Gullman) see column 1 lines 9-12	1, 2, 3

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.

E Patent document published on or after, but with priority date earlier than, the filing date of this application.

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/DE 00/02543

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 G07C9/00 G06K9/68

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RESEARCHIERTE GEBIETE

Recherchierte Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 G07C G06K

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

EPO-Internal, PAJ, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	GB 2 229 305 A (BRITISH TELECOMM) 19. September 1990 (1990-09-19)	1
A	Zusammenfassung Seite 2, Zeile 23 -Seite 5, Zeile 9	2-4
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 05, 31. Mai 1996 (1996-05-31) & JP 08 016788 A (YUUSEIDAIJIN;OTHERS: 02), 19. Januar 1996 (1996-01-19) Zusammenfassung	1
A	GB 2 229 844 A (NAT RES DEV) 3. Oktober 1990 (1990-10-03) Zusammenfassung Seite 3, Zeile 11 - Zeile 23 Seite 7, Zeile 34 -Seite 8, Zeile 2	2

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18. Dezember 2000

Absenddatum des internationalen Recherchenberichts

27/12/2000

Name und Postanschrift der internationalen Recherchenbehörde
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Bevollmächtigter Bediensteter

Teutloff, H

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internat. Aktenzeichen

PCT/DE 00/02543

Im Recherchenbericht angeführtes Patentedokument		Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
GB 2229305	A	19-09-1990	HK	127496 A	26-07-1996
JP 08016788	A	19-01-1996	KEINE		
GB 2229844	A	03-10-1990	EP	0454750 A	06-11-1991
			WO	9008366 A	26-07-1990
			JP	4502717 T	21-05-1992

INTERNATIONAL SEARCH REPORT

International Application No

PCT/DE 00/02543

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G07C9/00 G06K9/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G07C G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 229 305 A (BRITISH TELECOMM) 19 September 1990 (1990-09-19) abstract	1
A	page 2, line 23 -page 5, line 9	2-4
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 05, 31 May 1996 (1996-05-31) & JP 08 016788 A (YUUSEIDAIJIN;OTHERS: 02), 19 January 1996 (1996-01-19) abstract	1
A	GB 2 229 844 A (NAT RES DEV) 3 October 1990 (1990-10-03) abstract page 3, line 11 - line 23 page 7, line 34 -page 8, line 2	2



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

18 December 2000

Date of mailing of the international search report

27/12/2000

Name and mailing address of the ISA

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Authorized officer

Teutloff, H

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat. Application No

PCT/DE 00/02543

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2229305 A	19-09-1990	HK 127496 A	26-07-1996
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		JP 4502717 T	21-05-1992

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